OPERANT CONDITIONING LAB PACKAGE

MANUAL FOR MED-PC® IV APPLICATION

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Med Associates, Inc.
P.O. Box 319
St. Albans, Vermont 05478
www.med-associates.com

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CHAPTER 1
Introduction

The latest version of MED-PC® IV gives researchers the ability to use pre-programmed applications such as this one to make data collection easy. These pre-programmed applications can also be modified to meet the evolving demands of a research protocol. This manual begins by providing step-by-step instructions on how to use each of the pre-programmed applications. Then, the manual provides some examples of editing and modifying the programming code, and finally it defines the elements in the raw data file produced by this application.

In addition to this manual, refer to the **MED-PC® Version IV User's Manual** for the installation of the MED-Associates interface drivers, the MED-PC IV Software, and the Delphi® Compiler. Also refer to the User's Manual for instructions on hardware configuration. The Hardware Configuration software utility accompanies MED-PC IV and is used to assign the inputs and outputs in the interface cabinet for each task controlled by the program. Data file structure, file-saving format, and other related options are also determined by the Hardware Configuration software utility. Refer to the **MED-PC IV Programmer's Manual®** if you are unfamiliar with the process of translating and compiling an application.

The staff at Med Associates, Inc., is available to answer any questions that may arise. Please e-mail us at support@med-associates.com with a detailed description of the problem or desired goals so that we may provide concise and detailed information.

The **Operant Laboratory Package** and its pre-programmed reinforcement schedules are designed to be as easy to use as possible. MED Associates understands that researchers do not have the time to devote to programming and hardware design, and for that reason, we have undertaken that burden for you. We sincerely hope that you are satisfied with the products and services we provide, and look forward to meeting your future experimental needs as your research program evolves.

Thank you for purchasing the Operant Conditioning Laboratory Package for MED-PC.

Description of the Operant Conditioning Laboratory Package

The Operant Laboratory Package consists of five MedState Notation procedures that are well suited for a research or student lab. Dr. Steven Dworkin at the University of North Carolina, Wilmington, designed these procedures. The package includes the following reinforcement schedules:

- Fixed Ratio (FR-X)
- Fixed Interval (FI-X)
- Differential Reinforcement of Zero Responding (DRO)
- Inter-Response Time Less (IRT < X)
- Inter-Response Time Greater (IRT > X)

The procedures all make use of MED-PC IV's *Named Variables* to make running and modifying the schedules very straightforward. For example, the Fixed Interval (FI) procedure uses the following Named Variables:

- Correct Lever (Left = 1 Right = 2)
- Reward (Pellet =1, Dipper = 2, Drug = 3)
- Reward Time (sec)
- Time Out Following Reward (sec)
- Session Time (min)
- Fixed Interval Value (sec)
- Maximum Reinforcers (number of reinforcing events, or trials)
- SoftCR Pro Data Array (Yes=1 No=0), used to print cumulative records using SOF-722 software

Trial data are conveniently stored in an array that prints out in a one row per trial format. Similar data are collected for all the procedures. For example, the dependent variables collected in the FI procedure include:

- Total Responses
- Correct Response Count
- Incorrect Response Count
- % Correct
- % Incorrect
- Trial Number
- Correct Responses
- Incorrect Responses
- Pause Time (sec)
- Run Time (sec)

Overview of the Procedures

FR.mpc

When the fixed ratio program loads, the house light and the stimulus light above the correct lever turn on. Once the FR has been satisfied, a reward is issued, followed by a Time Out (TO). Both levers are inactive during the TO, but responses on these levers are counted as incorrect responses.

Variable	Settings	Default Value
Correct Lever	Left = 1; Right = 2	Left
Reward Device	Pellet = 1; Dipper = 2; Drug = 3	Pellet
Reward Time (sec)	User Defined	0.05 sec
Time Out Following Reward (sec)	User Defined	0 sec
Session Time (min)	User Defined	60 min
Fixed Ratio Value	User Defined	1
Maximum Reinforcers	User Defined	50
SoftCR Pro Activation	Yes = 1; No = 2	Yes

FI.mpc

The Fixed Interval (FI) schedule is programmed so that reward is delivered only in the event that a single response has occurred after a user-defined Fixed Interval Value (in seconds) has expired.

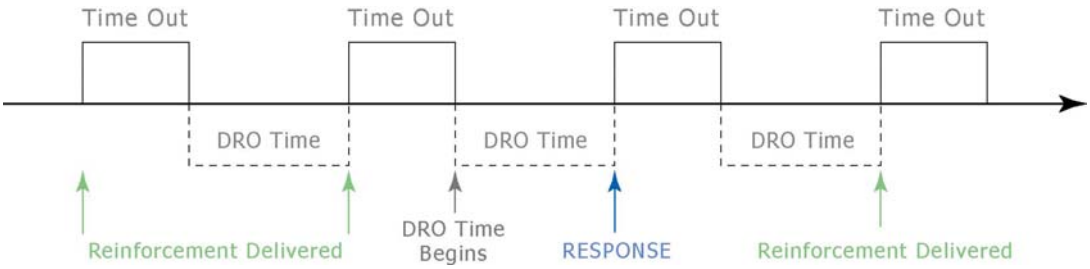
When the fixed interval program loads, the house light and the stimulus light above the correct lever turn on. Once the FI has been satisfied, a reward is issued, followed by a Time Out (TO). Both levers are inactive during the TO, but responses on these levers are counted as incorrect responses.

Variable	Settings	Default Value
Correct Lever	Left = 1;Right = 2	Left
Reward Device	Pellet = 1; Dipper = 2; Drug = 3	Pellet
Reward Time (sec)	User Defined	0.05 sec
Time Out Following Reward (sec)	User Defined	0 sec
Session Time (min)	User Defined	60 min
Fixed Interval Value (sec)	User Defined	1 sec
Maximum Reinforcers	User Defined	50
SoftCR Pro Activation	Yes = 1; No = 2	Yes

DRO.mpc

Differential Reinforcement of Zero Responding is a procedure that reinforces non-response. A time-out interval follows reinforcement and/or the occurrence of a response. The DRO Time is user-defined, but the default interval is 20 seconds.

Figure 1.1 - The DRO Timeline



Variable	Settings	Default Value
DRO Time (sec)	User Defined	20 sec
Reward	Pellet = 1; Dipper = 2; Drug = 3	Pellet
Reward Time (sec)	User Defined	0.05 sec
Time Out Following Reward (sec)	User Defined	0 sec
Session Time (min)	User Defined	60 min
Response Count Time After Reward (sec)	User Defined	60 sec
Maximum Reinforcers	User Defined	50
SoftCR Pro Activation	Yes = 1; No = 2	Yes

IRT Greater.mpc or IRT Less.mpc

The Inter-Response Time *Greater Than* (IRT > *X*) or *Less Than* (IRT < *X*) are schedules that are used to modify the rate of responding within an operant chamber. The independent variables for these schedules define the interval between responses, so that:

IRT Greater: The Inter-Response Time is the minimum interval between responses that needs to be exceeded before reinforcement will be delivered. If the IRT = 5 seconds, then the first response and the second response need to be separated by a minimum of 5 seconds. Responses separated by less than 5 seconds will not be followed by reinforcement.

IRT Less: The Inter-Response Time is the maximum interval separating responses. If the IRT = 5 seconds, then the inter-response interval must not exceed 5 seconds in order for the reward to be delivered. This schedule can be used to facilitate a rapid rate of responding within the operant chamber.

Variable	Settings	Default Value
Correct Lever	Left = 1; Right = 2	Left
Reward	Pellet = 1; Dipper = 2; Drug = 3	Pellet
Reward Time (sec)	User Defined	0.05 sec
Time Out Following Reward (sec)	User Defined	5 sec
Session Time (min)	User Defined	60 min
Inter-Response Time sec)	User Defined	5 sec
Maximum Reinforcers	User Defined	50
SoftCR Pro Activation	Yes = 1; No = 2	Yes

CHAPTER 2
Getting Started

Software Installation

Please refer to the **MED-PC IV User's Manual** for a complete guide to installing the MED-PC IV software, building a valid Hardware configuration with the Hardware Configuration utility, and opening and compiling a MSN procedure in the Trans-IV utility.

To install the Operating Conditioning Lab Package Procedures, insert the CD into the CD-ROM drive and click **Install the Operant Conditioning Software**. The Operant Conditioning procedures are copied into the C:\MED-PC IV\MPC folder.

Backing Up the Software

Med Associates strongly encourages creating backup copies of the programs in case of disk failure. Having copies of the original programs may be useful in the future should modifications be made to the existing programs.

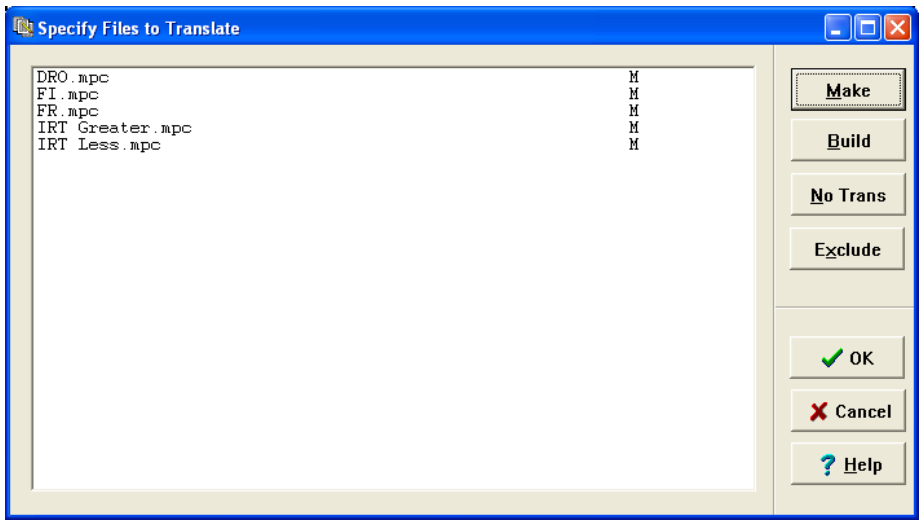
CHAPTER 3
Beginning & Running an Experiment

Translating The MED-PC IV (.mpc) File

Programs written in MedState Notation must be translated using Trans IV before they can be executed in this application. Be sure that a copy of the file being translated is present in the directory "C:\MED-PC IV\MPC\." Double click the Trans IV icon on the Start | Programs list or desktop and select **Translation | Translate and Compile**.

Select the program(s) to use for the experiment and click **Make**. Click **OK** to start the translator, and it will automatically parse the MedState Notation and then open to a DOS screen to compile the Pascal code. Depending on the speed of the computer, each of these steps may not be seen. If any problems are encountered during this process, refer to the on-screen help menu or the **MED-PC Version IV User's Manual**, or contact MED Associates, Inc. for assistance.

Figure 3.1 - Trans IV Control Panel for Translating and Compiling MedState Notation Code



Using the MED-PC IV Load Wizard

MED-PC IV is designed to help the researcher run an experiment by guiding selection choices through its Experiment Loading Wizard. This section will describe how to initiate the FR.mpc application, however the following steps that will also apply to all other .mpc procedures.

Open MED-PC IV and the MED-PC Experiment Loading Wizard's Welcome screen, shown in Figure 3.2 will appear.

Figure 3.2 - The MED-PC IV Loading Wizard Welcome Screen

MED-PC Experiment Loading Wizard
Welcome
This wizard will guide you through starting experiments and setting session parameters.
Run this expert automatically when starting MED-PC.
Close
Next

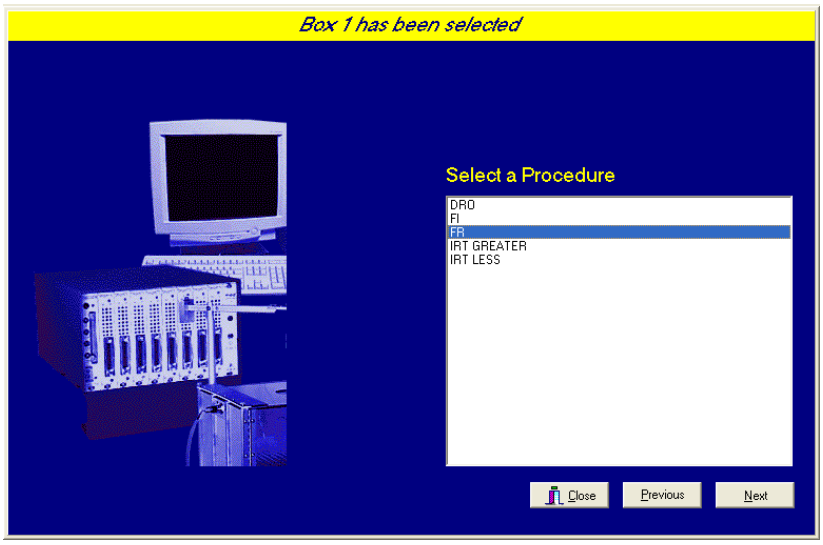
To avoid this load wizard, deselect the checkbox labeled **Run this experiment automatically when starting MED-PC**. Close this screen by clicking the **Close** button. Closing this screen immediately reveals the MED-PC Run-Time Screen shown in Figure 3.9. If the choice to continue with the Loading Wizard is made, then click the **Next** button.

The Box Selection screen will appear next, as shown in Figure 3.3. From this screen the researcher chooses which boxes will be used in the experiment. Select the boxes that will run the experiment by clicking in the radio button next to the box number. The figure shows that the Hardware Configuration included only 1 box, which was selected. Click **Next** to continue.

Figure 3.3 - The Box Selection Screen

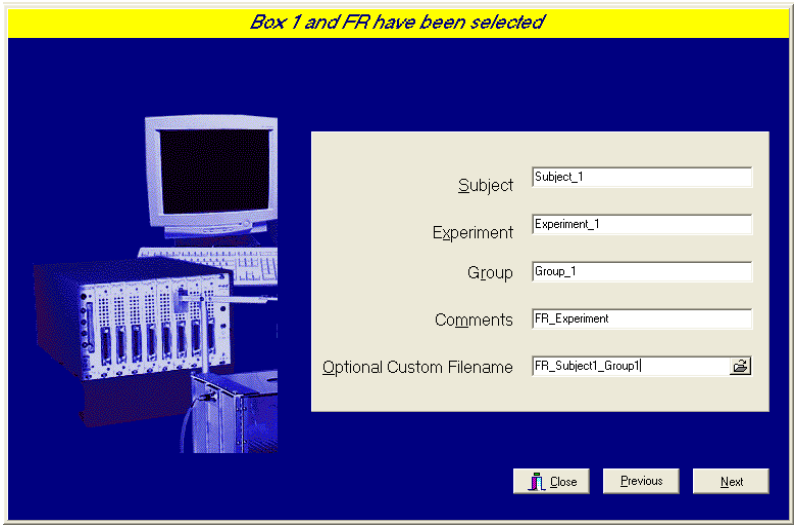
The Select a Procedure screen appears next, as seen in Figure 3.4. This is where the application to be run is selected. The screen displays a list of all the currently compiled procedures. Select the desired procedure and then click **Next**.

Figure 3.4 - The Select a Procedure Screen



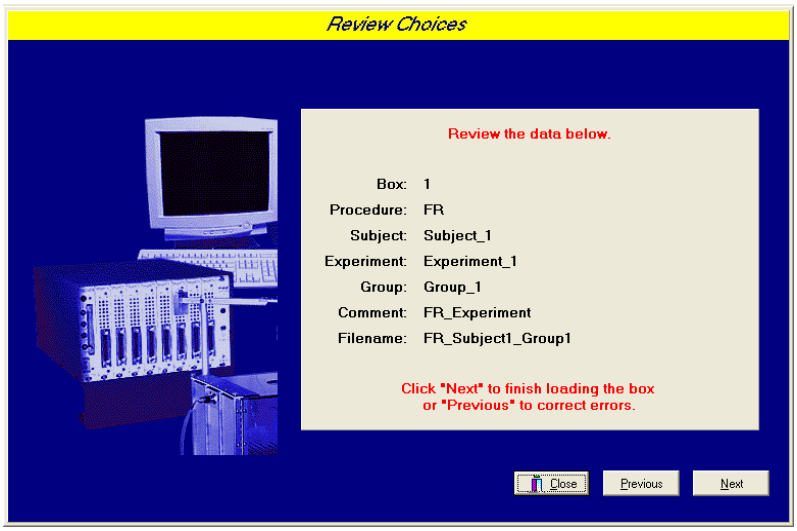
The Enter Experiment Data Screen should display next, as shown in Figure 3.5. The purpose of this screen is to allow annotations to be added to the data file that is produced by MED-PC IV. These annotations will help identify the Subject, Experiment, and Experiment Group upon which data was collected. Comments can be added here as well, and the data file can be given a customized file name to help identify it from other data files. Enter the information desired, and click **Next**.

Figure 3.5 - Enter Experiment Data Screen



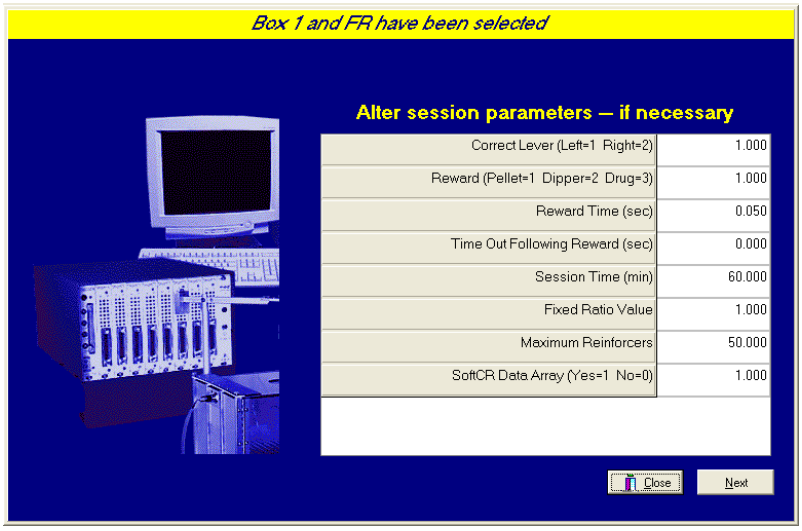
The next screen to appear is the Review Choices screen, as seen in Figure 3.6. This is a method of confirming that the information received from the Box/Procedure Selected is correct. If it is not correct, select **Previous**, and edit the data. If it is correct, select **Next**.

Figure 3.6 - Review Choices Screen



The Alter Session Parameters Screen, shown in Figure 3.7, is the next screen to appear, and is an important screen for the researcher. The Alter Session Parameters screen allows the researcher to alter the parameters by which a procedure executes. The Send Start Command Screen appears next. The options available on the screen vary depending upon how many boxes are described in the Hardware Configuration.

Figure 3.7 - Alter Session Parameters Screen


Box 1 and FR have been selected
Alter session parameters — if necessary
Correct Lever (Left=1 Right=2) 1.000
Reward (Pellet=1 Dipper=2 Drug=3) 1.000
Reward Time (sec) 0.050
Time Out Following Reward (sec) 0.000
Session Time (min) 60.000
Fixed Ratio Value 1.000
Maximum Reinforcers 50.000
SoftCR Data Array (Yes=1 No=0) 1.000
Close
Next

In this example only 1 box is described in the Hardware Configuration, so Figure 3.8 will appear next. If more than 1 box is in the Hardware Configuration, then Figure 3.9 will appear.

Figure 3.8 - Send Start Command Screen for Single Box Configuration

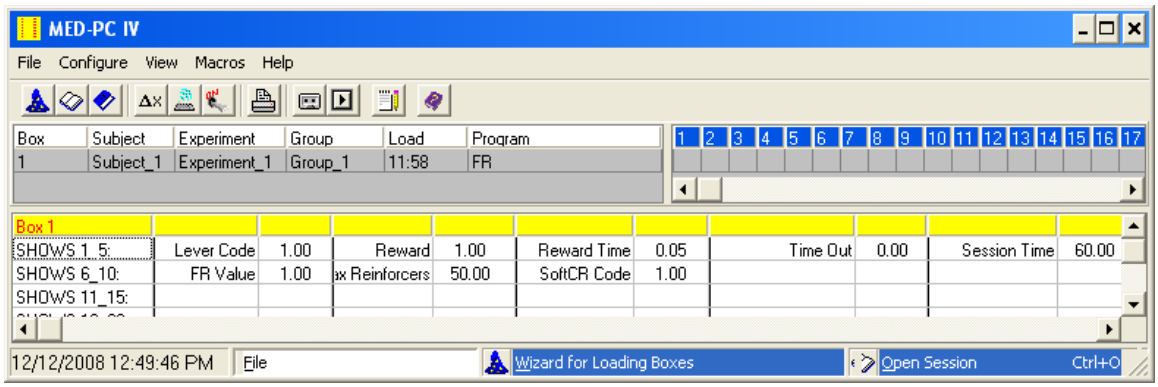
Load More Boxes or Send Start Command?
I want to send start signals to already loaded boxes
I am finished with the wizard
Close
Continue

Figure 3.9 - Send Start Command Screen for Multiple Box Configuration

Load More Boxes or Send Start Command?
I want to load more boxes
I want to send start signals to already loaded boxes
I am finished with the wizard
Close
Continue

In both cases (Figure 3.8 and Figure 3.9), the screens are where the researcher decides to either load more boxes, send a start signal to boxes that are already loaded, or enter the MED-PC IV run-time environment without sending a start signal by selecting "I am finished with the wizard". This option results in the screen shown in Figure 3.10.

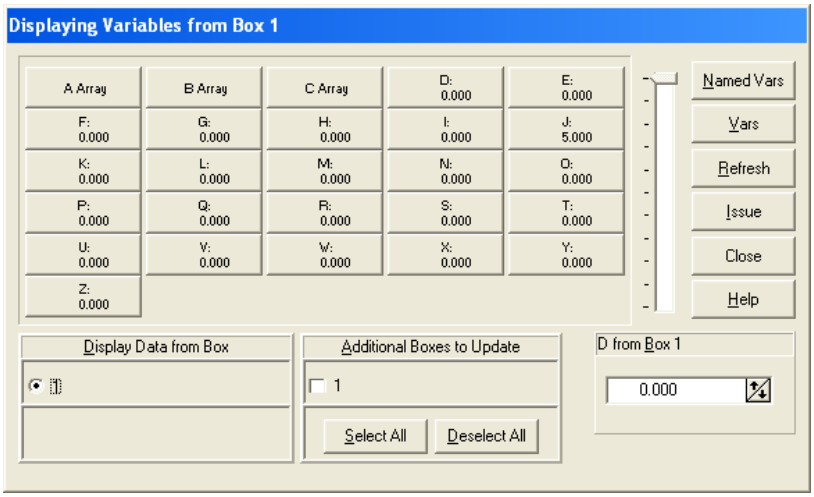
Figure 3.10 - The MED-PC IV Run-Time Screen


MED-PC IV
File Configure View Macros Help
Box Subject Experiment Group Load Program
1 Subject_1 Experiment_1 Group_1 11:58 FR
Box 1
SHOWS 1_5: Lever Code 1.00 Reward 1.00 Reward Time 0.05 Time Out 0.00 Session Time 60.00
SHOWS 6_10: FR Value 1.00 ax Reinforcers 50.00 SoftCR Code 1.00
SHOWS 11_15:
12/12/2008 12:49:46 PM
File
Wizard for Loading Boxes
Open Session Ctrl+O

Viewing/Changing Variable Values

Before a "start command" has been issued, any variable may be changed on the MED-PC IV run-time screen. Simply highlight the value to change, and then enter the new value. Once a session is in progress, change variables by selecting **Configure | Change Variables**, or click the 4th tool bar item **ΔX**. In the lower left hand corner of the Change Variables window, find the "Display Data from Box" display, and choose the chamber(s) to modify. By clicking additional boxes in the "Additional Boxes to Update" section, changes made to a single box are automatically loaded to all of the selected boxes.

Figure 3.11 - Changing Variables Screen



The value of any simple variable may be viewed from this screen by clicking an array on the table and each element in that array can be viewed, as shown in Figure 3.12. To change a value, simply highlight and replace the value in the lower right hand box or use the up/down arrows to increment by 1. Click the **Issue** button for the change to take effect. Click **Named Variables** to produce the display in Figure 3.13. Change variables here as needed.

Figure 3.12 - Displaying Array A from Box 1

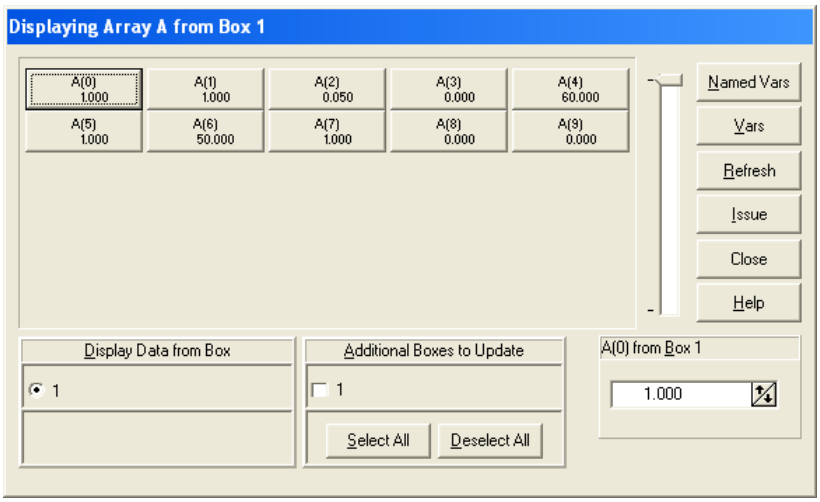
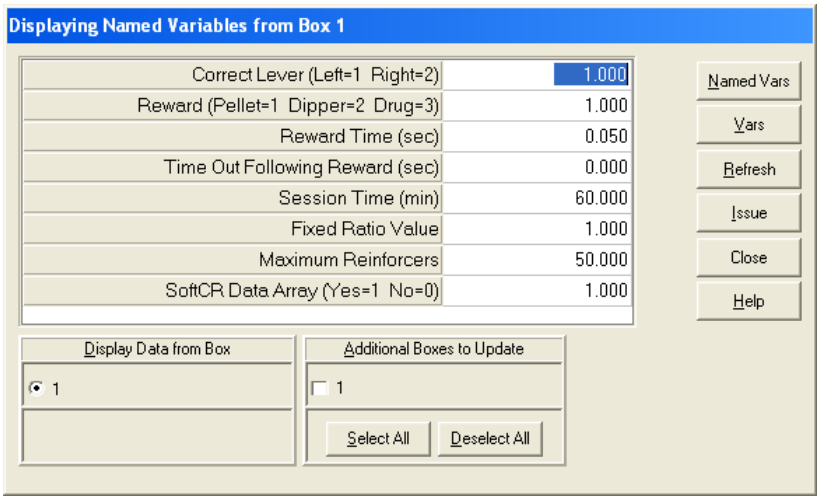


Figure 3.13 - Displaying Named Variables from Box 1

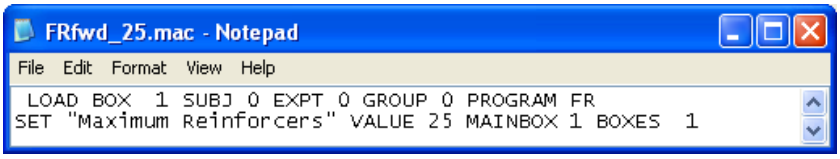


Macros

The simplest way to initially create a macro is to record keyboard functions while performing the steps manually. Once the commands are in the macro, it is easy to create a number of macros with the macro editor. The following example illustrates the process of loading "Box 1" and changing "Maximum Reinforcement" to 25.

To begin, open MED-PC IV and going directly to the run time screen. Close the load wizard, if present. Before loading or opening the procedure, click **Macro** on the main menu and select **Turn On Macro Recorder** or click the 8th tool bar item with the cassette tape icon on top. A note on the bottom of the display indicates that the recorder is running. Open "FR.mpc" by clicking **Files | Open Session**. Change the variables using any of the methods described above. When all settings have been made, turn the recorder off again by using the main menu or tool bar. Save the macro with a distinctive name. The example in Figure 3.14 was named "FRfwd_25.mac" since the maximum reinforcement number was changed to 25.

Figure 3.14 - FRfwd_25.mac

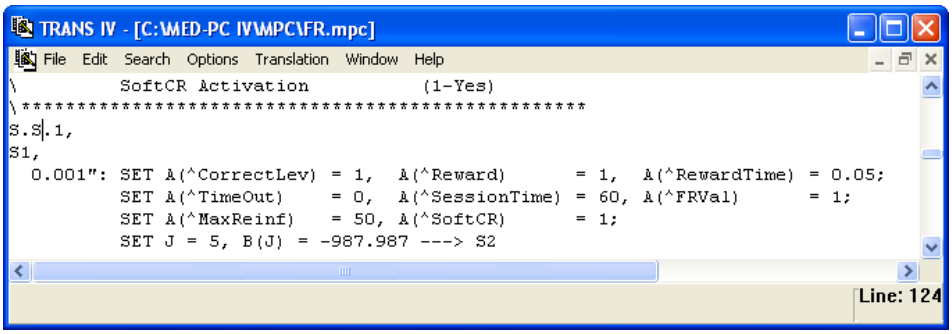

FRfwd_25.mac - Notepad
File Edit Format View Help
LOAD BOX 1 SUBJ 0 EXPT 0 GROUP 0 PROGRAM FR
SET "Maximum Reinforcers" VALUE 25 MAINBOX 1 BOXES 1

Once this macro is built, use the macro editor to make simple changes such as replacing reward or correct lever values. Review the Help file on screen or the **MED-PC IV User's Manual** for more information on macros and the features offered. A START command or message box followed by a START command could be added to the macro (it was left off here so changes could be verified before starting the procedure).

Modifying the MedState Notation Code

Permanent changes to the FR procedure ("FR.mpc") can be made to the MedState Notation code. To make the same change to the "maximum reinforcement number" as shown above, do the following. Open Trans IV and select **File** | **Open** to place FR.mpc into the text editor. Scroll down to approximately line 124 (note the line counter in the lower right hand corner of the editor) to reveal the code shown in Figure 3.15.

Figure 3.15 - FR.mpc Lines 124-139


TRANS IV - [C:\MED-PC IV\MPC\FR.mpc]
File Edit Search Options Translation Window Help
\ SoftCR Activation (1-Yes)
\ **
S.S.1,
S1,
0.001": SET A(^CorrectLev) = 1, A(^Reward) = 1, A(^RewardTime) = 0.05;
SET A(^TimeOut) = 0, A(^SessionTime) = 60, A(^FRVal) = 1;
SET A(^MaxReinf) = 50, A(^SoftCR) = 1;
SET J = 5, B(J) = -987.987 ---> S2
Line: 124

Change A(^MaxReinf) =50 to A(^MaxReinf) =25 and save the changes with the same or a new file name such as FRmax_25fwd.mpc. Remember, if creating a new .mpc file name and are using a macro to load boxes, the file name in the macro also must be changed. Translate and compile the new or changed file as described previously and run MED-PC IV. Use the "Change Variables" screen to view/confirm the new values.

Modifying MedState Notation for Chambers with Retractable Levers

If an operant chamber with retractable levers is being used, it is necessary to include a command to release the levers forward at the beginning of the experiment. Do this by modifying the following lines of the MedState Notation code.

Modify the MedState Notation on line 143 of FR.mpc to read:

```
ON^HouseLight, ^LeftLight, ^Rightlight, ^LeftLever, ^RightLever---> S3;
```

Modify the MedState Notation on line 170 of FR.mpc to read:

```
0.01": OFF ^HouseLight, ^LeftLight, ^RightLight, ^LeftLever, ^RightLever;
```

CHAPTER 4
Understanding the Data Files

Unless otherwise specified, data will be saved to C:\MED-PC IV\DATA. Data can be saved manually by selecting **FILE | SAVE DATA MANUALLY** or **FILE | SAVE DATA (FLUSH)**. The file name that is used to save the data in depends on the option that was chosen in the Hardware Configuration Utility and may also be dependent on the Subject, Experiment, and Group name provided in the MED-PC IV load wizard. Within each data file, the headings are created for each Subject, Experiment, Group, Box, etc., (see below). Data files may be opened with note pad, word pad, or any word processor or spreadsheet; however, be sure they are always saved "unformatted" in case a data extraction utility such as MED-PC to Excel might ever be used. Data file formats are explained in detail in the **MED-PC IV User's Manual**.

Sample Data File

Select **Annotated** on the file options page during hardware installation to produce a raw data file similar to the following. Data files are located in C:\MED-PC IV\Data\ unless an alternate path was defined during hardware installation. They may be opened with note pad, word pad, or any word processor; however, make sure they are always saved unformatted in the occasion a data extraction utility such as MPC2XL is used. The header information should be self-explanatory. Data-file formats are explained in detail in the **MED-PC IV User's Manual**.

```
Start Date: 12/12/08
End Date: 12/12/08
Subject: Subject_1
Experiment: Experiment_1
Group: Group_1
Box: 1
Start Time: 13:34:38
End Time: 13:40:12
MSN: FR
D:       0.000          Not Used
E:       0.000          Not Used
F:      17.000          Total Rewards
G:       0.000          Not Used
H:       0.000          Not Used
I:      56.000          Subscript for the IRT Array C
J:      90.000          Subscript for the Trial Array B
K:       0.000          Not Used
L:       0.000          Ratio Count
M:       0.000          Not Used
N:       0.000          Not Used
O:       0.000          Not Used
P:       0.000          Not Used
Q:       0.000          Not Used
R:       0.000          Not Used
S:     300.000          Elapsed Time in the Session
T:    1003.000          Elapsed Time in 0.01 second Increments for SoftCR Pro Data
U:       0.000          Not Used
V:       0.000          Not Used
W:       0.000          Not Used
```

```
X:       0.000          Not Used
Y:       0.000          Not Used
Z:       0.000          Not Used

A:                                                 Reward Time    T.O. Following   Session Time
                Correct Lever      Reward          (sec)          Reward (sec)     (min)
     0:           1.000             1.000          0.050          0.000            5.000
                F.R. Value         Max. Reinforcers SoftCR Data Array
     5:           1.000             50.000         1.000          0.000            0.000

B:                                 Total Correct  Total Incorrect
                Total Responses    Responses      Responses      % Correct        % Incorrect
     0:          27.000            17.000         10.000         0.630            0.370
                                   Correct        Incorrect
                Trial Number       Responses      Responses      Pause Time       Run Time
     5:           1.000             1.000          0.000          0.000            0.000
    10:           2.000             1.000          1.000          9.000            0.000
    15:           3.000             1.000          0.000          1.000            0.000
    20:           4.000             1.000          2.000         37.000            0.000
    25:           5.000             1.000          0.000          5.000            0.000
    30:           6.000             1.000          3.000         37.000            0.000
    35:           7.000             1.000          0.000         16.000            0.000
    40:           8.000             1.000          0.000         23.000            0.000
    45:           9.000             1.000          1.000         58.000            0.000
    50:          10.000             1.000          0.000         25.000            0.000
    55:          11.000             1.000          0.000          6.000            0.000
    60:          12.000             1.000          1.000         10.000            0.000
    65:          13.000             1.000          0.000          1.000            0.000
    70:          14.000             1.000          1.000         30.000            0.000
    75:          15.000             1.000          1.000         13.000            0.000
    80:          16.000             1.000          0.000          1.000            0.000
    85:          17.000             1.000          0.000          4.000            0.000
    90:          18.000             0.000          0.000         12.000            0.000

C:
     0:           0.500           418.100            0.200          577.600            0.500
     5:         368.100             0.200          183.100            0.200         1023.600
    10:           0.500           738.600            0.500         2033.100            0.200
    15:         566.100             0.200         1443.600            0.500          172.600
    20:           0.500           483.600            0.500         1700.100            0.200
    25:        1670.100             0.200         2338.100            0.200         1194.600
    30:           0.500          4666.100            0.200         2558.100            0.200
    35:         605.100             0.200          357.600            0.500          660.100
    40:           0.200           193.100            0.200         1402.600            0.500
    45:        1659.100             0.200          754.600            0.500          591.100
    50:           0.200           193.100            0.200          453.100            0.200
    55:        1003.310
\FR_Experiment
```

CHAPTER 5
SoftCR Pro

Each Operant Conditioning Laboratory procedure stores IRT data in array C that may be used by the SoftCR Pro Cumulative Recorder program to generate a graphical record on screen or to print a Cumulative Record after the data has been collected. Each element in this "Cumulative Record" data array consists of two components. The integer value or value to the left of the decimal point is the time component. The decimal value or value to the right of the decimal point is a SoftCR Pro code component.

Time Components

Time components may be Relative or Absolute. In a Relative file, the time component of a given data element is equal to the elapse time since the previous element. In an Absolute file, it is equal to the elapse time since the beginning of the Record. The elements used in Operant Conditioning are all Relative with a resolution of 0.01 seconds (10 milliseconds). For example, if array C contained just two elements 350.1 and 330.1, the record would consist of one Response Step at 3.5 seconds (350 * 0.01) and a second Response Step 3.3 seconds later at 6.8 seconds on the X-Axis.

Control Code Components

The control code component indicates whether the element is a Response Step, Reinforcement Pip, Pen Reset, Event Pen Up, or Event Pen Down element. Up to 10 Event Pens (0 - 9) and 10 Trace Pens (0 - 9) may be specified in MED-PC. In addition, Resets may be made with the Pen "Up" (no vertical tracing) or "Down." Additional coded information may be possible in the future.

Data Element Format

Each data element must conform to the following format:

nnnnn.xyz

Where:

nnnnn = Time Component

xyz = Control Code Component

x = Datum Type

y = Datum Index

z = Don't Care Digit

NOTE: If there are more then three numbers past the decimal point, then the array will be considered invalid and will be ignored by SoftCR Pro.

Allowed datum types and indices are:

nnnnn.1yz = Response or Step

y = Index (0 - 9) for Multi-Trace Files

"NULL" for Single Trace Files

nnnnn.2yz = Reinforcement or Pip

y = Index (0 - 9) for Multi-Trace Files

"NULL" for Single Trace Files

nnnnn.3yz = Reset Trace Pen

For Single Trace data files and y is Pen Mode where:

y = 0; Trace 0 Pen Up During Reset

y = 1; Trace 0 Pen Down During Reset

Note: This format overrides the Up/Down option in edit parameters.

For Multi-Trace data files:

y = Index (0 - 9)

nnnnn.4yz = Unused

nnnnn.5yz = Set Event Pen To Level 0 ("Down" or at baseline), where

y = Event Pen Number (0 - 9)

nnnnn.6yz = Set Event Pen To Level 1 ("Up"), where

y = Event Pen Number (0 - 9)

nnnnn.7yz = Unused

nnnnn.8yz = Unused

nnnnn.9yz = Unused

Data in the array being plotted that does not conform to the above rules will be ignored.

Example of SoftCR Pro

Figure 5.1 is an example of what a Fixed Ratio schedule will look like in SoftCR Pro after an experiment is run. The red line records a Step for every correct response that is made. Since this is a Fixed Ratio of 1 schedule the subject was reinforced for each response it made. A reward is recorded as a Pip, or a hash mark on the red line. The black lines at the bottom of the screen are called Event Pens and can be used in a variety of ways for a number of purposes. The black line can go up and down, creating quick Spikes like the ones seen here, or long plateaus that represent certain periods of time during an experiment. Here, the Event Pen 0 records a Spike for every incorrect response that is made. Event Pen 1 records plateaus for Time-Out times, if applicable.

Figure 5.1 - Example of a Fixed Ratio Schedule Shown in SoftCR Pro